
Appendix A

Control of Tobacco Production and Use

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Tobacco was cultivated in the Americas more than 3,000 years ago and is believed to have originated there. By the arrival of Columbus in 1492, tobacco was being chewed, smoked, or snuffed in many areas of both North and South America.

Tobacco cultivation was spread, primarily by the Spanish and the Portuguese, to Europe, Africa, India, Turkey, Russia, China, and Japan by the early 1600s. By 1620 the Virginia colony in North America was growing tobacco commercially for export. This lucrative trade helped to develop both the American colonies and the English merchant navy.

In the 1700s and the early 1800s, large quantities of tobacco were being snuffed by the aristocracy of Europe and chewed by the American pioneers as they pushed westward. By the middle of the 1800s, however, the technology for making cigarettes and flue-curing tobacco had been developed, and the chewing of tobacco was beginning to be seen as unhygienic. By World War I the mass production of cigarettes had begun, and smoking rates among men in industrial countries began to rise dramatically. Cigarette smoking became popular among women in industrial countries starting about the time of World War II. At this time, smoking rates also began to rise in men in developing countries. Filtered cigarettes became popular in the 1950s, and in the 1960s low-yield cigarettes entered the marketplace. Today, tobacco is cultivated commercially in more than 120 countries and is consumed in all countries of the world.

Tobacco production and consumption influence various sectors of society in different ways, some negatively and some positively. As a result, it is important to consider the perspectives of these various sectors, including the individual tobacco user, the tobacco grower, the tobacco industry, the health community, and governments. My objective in this chapter is to review the influence of tobacco on each sector, to determine the health and economic effect of tobacco, and to evaluate strategies to control its use.

The Adverse Effects of Tobacco

Although the major diseases associated with tobacco have been known for more than thirty years, only recently have many of the other health problems been firmly established.

Similarly, the adverse effects of tobacco on members of the family, coworkers, businesses and the environment have been investigated only in the last few years.

Health Effects

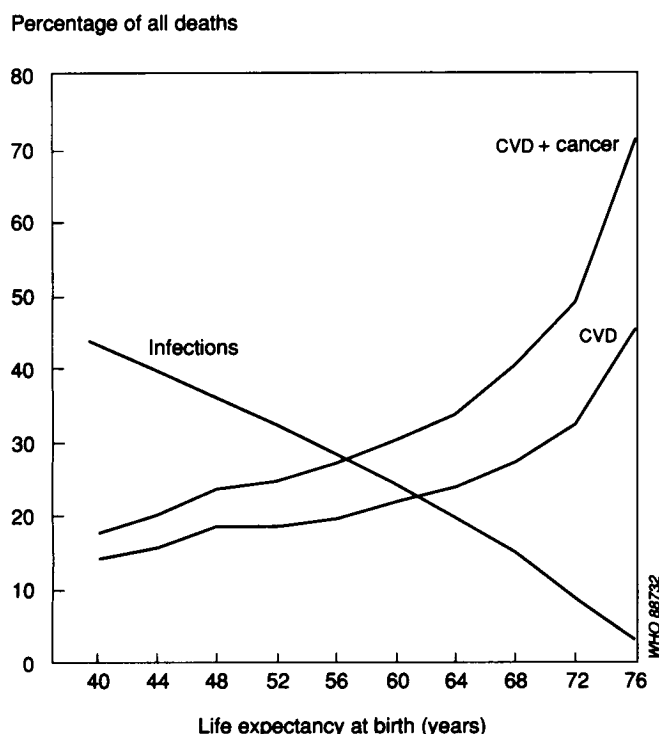
The three leading causes of mortality for the productive age group between fifteen and sixty-five years in both industrial and developing countries are cardiovascular diseases, cancer, and accidents (WHO 1980). Chronic diseases are well recognized as significant health problems in the industrial regions of the world. The prevalence of communicable diseases among children, however, often hides the fact that chronic diseases are also becoming a serious problem in developing countries. Life expectancy in those countries has risen from 41.0 years in 1950–55 to 57.6 years today; it is projected to reach 70.4 years by 2020–25 (United Nations 1989). The correlation between life expectancy and mortality from cardiovascular diseases, cancer, and infection is given in figure A-1.

The association between tobacco use and ill health has been reviewed by many national and international committees and organizations. Consistently, they conclude that tobacco use is a significant cause of disability and premature death (RCP 1983; WHO 1986; USDHHS 1989a). Worldwide, approximately 3 million premature deaths per year are due to tobacco smoking (see table A-1). In Europe alone, there are more than 500,000 such deaths each year; in the United States, the corresponding figure is 434,000, or one-sixth of all deaths. More than a quarter of all regular cigarette smokers die prematurely from smoking-related diseases.

The extent of mortality by disease that can be ascribed to tobacco has been determined for the United States and is presented in table A-2. Lung cancer is the single largest contributor, followed by ischemic heart disease. Lung cancer accounts for 26 percent of the mortality resulting from smoking. In the United States, about 1.2 million years of potential life before the age of sixty-five are lost each year, two-thirds among men and one-third among women (CDC 1991).

The rates of attributable mortality similar to those in table A-2 would be applicable for most industrial countries, in which smoking has been a widespread habit for many years. Smoking

Figure A-1. Relationship between Life Expectancy at Birth and Mortality from Cardiovascular Diseases, Cancer, and Infections



Source: Based on analysis of United Nations statistics (Omran 1971), modified by Dodu.

has only recently become popular in many developing countries, however, and the delay of twenty to twenty-five years between the time one begins to smoke and the onset of many of the most important associated diseases such as lung cancer means that current attributable rates calculated for developing countries will be somewhat less. Within ten to fifteen years, however, cigarette smoking will have been prevalent in many developing countries for sufficient time to be the cause of a mortality pattern closely approximating that currently seen in industrial countries. The change has already occurred in some regions. For example, in Shanghai County, a rural and urban area near the city of Shanghai, the leading causes of death in

the early 1960s were infectious diseases, accidents, respiratory diseases, digestive diseases, and neonatal deaths. But by the end of the 1970s, the most common causes of mortality in the area were cancer, cerebrovascular diseases, and heart diseases (Gu and Chen 1982). This shift in health problems took place in less than twenty years and is marked by the emergence of diseases caused by tobacco use.

One of the common hindrances of effective action against tobacco is the public's general lack of understanding of the relative importance of the various risks in daily living. Often, the local media provides continuous information about hazards from various factors with considerable sensationalism, in repeated attempts to grab the public's attention. As a result a large portion of the public believes everything causes cancer so why worry only about cigarettes. In reality, however, tobacco is the dominant public health hazard in industrial countries. In the United States and many other industrial countries, smoking is responsible for more deaths than heroin, cocaine, alcohol, acquired immunodeficiency syndrome (AIDS), fires, homicide, suicide, and automobile accidents—combined. In the United Kingdom, a report of the Royal College of Physicians expressed the extent of the problem by stating that among 1,000 young male adults in England and Wales who smoke cigarettes, on average about 1 will be murdered, 6 will be killed on the roads, and 250 will be prematurely killed by tobacco (RCP 1983).

CANCER. In countries in which smoking has been a widespread habit, it is responsible for 80 to 90 percent of lung cancer deaths and 40 percent of bladder cancer deaths. Tobacco is responsible for 30 percent of all cancer deaths, including some cancers of the oral cavity, larynx, esophagus, stomach, and cervix.

An important feature in the relation between cigarette smoking and lung cancer is the strong correlation between the duration of regular cigarette smoking and subsequent lung cancer rates. A doubling of duration of regular tobacco use will result in an increase in lung cancer incidence of approximately twenty-fold. This relationship holds particular relevance for projecting the health problems of countries in which substantial increases in tobacco smoking have occurred in the last decade but the full health effects have not yet been felt.

The concept that atmospheric pollution might be an important cause of lung cancer dates back to the 1930s, when it

Table A-1. Mortality Attributable to Smoking, by Region

Region	Deaths per year	Year	Source
United Kingdom	110,700	1988	Health Education Authority 1991
United States	434,000	1988	CDC 1991
Europe ^a	505,000	1985	WHO Regional Office for Europe 1988
Latin America	98,100	1985	USDHHS 1992
Industrial countries	1.7 million	1985	Peto and Lopez 1992
Worldwide	3.0 million	1990	WHO 1991

a. Excluding the former U.S.S.R.

Source: See last column.

Table A-2. Disease-Specific Mortality Attributable to Smoking, United States, 1988

<i>Disease</i>	<i>Males</i>	<i>Females</i>	<i>Total</i>
<i>Neoplasm</i>			
Lip, oral cavity, pharynx	4,942	1,460	6,402
Esophagus	5,478	1,609	7,087
Pancreas	2,775	3,345	6,120
Larynx	2,401	589	2,990
Trachea, lung, bronchus	78,932	33,053	111,985
Cervix	n.a.	1,246	1,246
Urinary bladder	2,951	963	3,914
Kidney, other urinary	2,729	363	3,092
<i>Cardiovascular disease</i>			
Hypertension	3,441	2,254	5,695
Ischemic heart disease			
Age 35-64	29,263	9,105	38,368
Older than 64	41,821	27,990	69,811
Other heart diseases	27,503	14,638	42,141
Cerebrovascular disease			
Age 35-64	5,121	4,504	9,625
Older than 64	11,554	5,134	16,688
Atherosclerosis	4,644	3,612	8,256
Aortic aneurysm	5,798	1,435	7,233
Other arterial disease	1,874	1,111	2,985
<i>Respiratory disease</i>			
Pneumonia, influenza	11,580	8,098	19,678
Bronchitis, emphysema	9,670	5,269	14,939
Chronic airways obstruction	29,838	16,884	46,722
Other respiratory diseases	828	690	1,518
<i>Conditions in infants</i>			
Short gestation, low birth weight	344	261	605
Respiratory distress syndrome	351	233	584
Other respiratory conditions	384	277	661
Sudden infant death syndrome	422	280	702
Burns	850	453	1,303
Passive smoking	1,330	2,495	3,825
Total	286,824	147,351	434,175

n.a. Not applicable.

Source: CDC 1991.

was observed that lung cancer rates were higher in cities than in towns. Subsequent investigations that have considered the effect of smoking habits, however, as well as national and international reviews, have led to the conclusion that no more than 10 cases per 100,000 males each year could be ascribed to atmospheric pollution in the high-risk populations and that the proportion of lung cancer attributable to smoking is of the order of 80 to 90 percent.

Oral cancer is a significant problem in South Asia, where the habit of chewing tobacco in the betel quid is common. Oral cancers almost always occur on the side of the mouth where the tobacco quid is kept, and the risk of cancer rises dramatically for those who keep the tobacco quid in the mouth overnight. Approximately 90 percent of oral cancers in this part of the world can be attributed to tobacco chewing and smoking habits (WHO 1984).

CARDIOVASCULAR DISEASES. Approximately 25 percent of ischemic heart disease deaths are due to smoking in countries in which smoking has been a common habit for many years (WHO 1979). The association with ischemic heart disease depends upon age, with the stronger effect for those at a younger age. As for lung cancer, the risk of death from ischemic heart disease decreases upon cessation of smoking.

Smoking is also associated with atherosclerosis, hypertension, and cerebrovascular disease. In addition to mortality, however, there is also significant morbidity associated with tobacco; for example, amputation due to vascular disease in the legs is common.

CHRONIC BRONCHITIS AND EMPHYSEMA. Soon after beginning to smoke, smokers develop a cough and produce more sputum than nonsmokers; respiratory infections tend to increase, and

lung function begins to be impaired. Approximately 75 percent of deaths from chronic bronchitis and emphysema are due to smoking. In pure economic terms, bronchitis is probably the most expensive of the smoking-related diseases because of the associated long-term morbidity. There is benefit in cessation of smoking at any stage of bronchitis.

PREGNANCY, WOMEN, AND CHILDREN. Maternal smoking results in slowing fetal growth because of reduction in the oxygen supply reaching the baby through the placenta, to the extent that children born to smoking mothers weigh an average of 200 grams less than those born to abstaining mothers. Tobacco use causes a twofold increase in the risk of spontaneous abortion and is associated with an increased risk of complications during pregnancy and labor. The perinatal risk is increased by 35 percent for women who smoke more than twenty cigarettes per day. It is estimated that more than 8,000 infant deaths each year in industrial countries are caused by parental smoking. The effects of tobacco use by mothers in developing countries, where birth weights are already low and perinatal risk high, have not yet been determined.

Smoking also increases the risk of cardiovascular disease for women who take contraceptive pills. Tobacco use is associated with increased rates of cervical cancer, and tobacco-related substances such as nicotine have been found in the cervical fluid of smokers. Further, natural menopause occurs about two or three years earlier among smokers than among nonsmokers.

PASSIVE SMOKING. The risk of lung cancer in nonsmokers married to smokers is increased 25 to 35 percent as a result of passive ("enforced") smoking, the breathing of other people's tobacco smoke. Children of parents who smoke have an increased incidence of bronchitis and pneumonia (NRC 1986; USDHHS 1986).

NICOTINE ADDICTION. All tobacco products contain nicotine, a powerful drug that causes addiction, that is, the user's behavior is controlled to a considerable extent by the pharmacologic agent. Mechanisms of this addiction are similar to those of heroin and cocaine (USDHHS 1988).

Effects on the Family

A tobacco habit by one or more family members often drains a significant portion of the family income, typically in the range of 1 to 5 percent of the income of a wage earner in both industrial and developing countries. Tobacco habits are more prevalent among the lower socioeconomic groups, and they tend to be the hardest hit financially. The effect is likely to be greater in the poorest developing countries. It has been calculated for Bangladesh that the smoking of only five cigarettes per day would result in a monthly dietary deficiency of approximately 8,000 calories in a poor household, seriously endangering the survival of a large number of children (Cohen 1981). Of course, smoking-related deaths and morbidity, such as debilitating respiratory diseases, also mean a loss of income to

the family. In addition to the effects on the health of the children of a smoking parent, and on that of nonsmoking adult family members, the children are more likely to grow up to be smokers also, with the resulting health problems for themselves, their spouses, and their children. Tobacco use among children is one of the risk-taking activities which appears to be associated with an increased use of alcohol and other drugs.

Effect on the Workplace

Only within the last few years have the consequences of a smoker in the workplace been realized. Studies in the United States (USDHHS 1985) have revealed the following:

- Smokers take 50 percent more sick leave and are 50 percent more likely to be hospitalized;
- Smokers are more than twice as likely to die during their working years (before age sixty-five);
- Smokers have twice as many on-the-job accidents;
- Smokers waste 2 to 6 percent of their working hours because of the smoking ritual;
- Corporations incur increased cleaning, repair, and maintenance costs because of smokers; and
- Nonsmoking workers suffer significant irritation, discomfort, and health risks caused by smokers.

The increased costs for life insurance (approximately 50 percent) and health insurance (30 percent) have been determined by insurance companies, and programs developed to return this money to the nonsmoking employees have served as inducements to promote some nonsmoking company policies in the United States. A West German branch of a U.S. computer firm recently gave nonsmoking employees an extra six days' vacation to compensate for cigarette breaks given year-round to smokers; as a result, 30 percent of the staff gave up smoking. It was estimated that in 1980 an average smoking employee costs an excess of \$400 to \$800 each year in 1983 values (Kristein 1983).

Effect on the Environment

Although only 0.3 percent of arable land worldwide is used to grow tobacco, most of this land could also be used to grow food and other crops. The reduction in food production associated with the growing of tobacco is likely to be associated with increased prices for food locally and, hence, lower nutritional status in the general population.

The growing of tobacco requires large quantities of pesticides and herbicides throughout most of its growing season. It also depletes soil nutrients at a higher rate than most other crops and requires either fertile soils or the extensive use of commercial fertilizers. In tropical developing countries, which often have poor soils, the result is that either the farmer consumes considerable fertilizer (at a substantial cost to the farmer or the government) or periodically seeks out new cropland, often by deforestation. A significant problem also arises

with the misuse of pesticides (purchased in larger-than-usual quantities because of the increased cash profitability of tobacco as a crop) and possible contamination of village water supplies as a result of poor training and lack of education of the farmers, a problem compounded by lack of health services in the area.

Deforestation has been called the most serious environmental problem now facing developing countries. Approximately one-half of tobacco grown is flue-cured; in poor countries without coal, such as Brazil and most of Africa, this means curing by the burning of wood. Farmers are taught the rule of thumb that one hectare of tobacco will need one hectare of wood for curing. In many developing countries areas of tobacco production are easily located by their lack of trees. The increase in erosion, deforestation, and prices of wood for other uses are among the results associated with the curing of tobacco. In response to this problem in Africa, the British-American Tobacco Company (BAT) has initiated a replanting plan, which, however, as yet has not produced a significant reversal of the trend.

It has been estimated that 7 to 11 percent of fire losses in the United States are associated with tobacco smoking, resulting in an annual cost of approximately one-third of a billion U.S. dollars (Kristein 1983). It is reasonable to suspect proportionally higher tobacco-smoking fire losses in developing countries.

Tobacco Production and Consumption

Tobacco products are among the items manufactured most frequently by mankind. Approximately 5 trillion cigarettes are produced each year, or 1,000 cigarettes for each man, woman, and child on earth.

Tobacco Habits

Worldwide, tobacco is consumed in a wide variety of ways, many in combination with other ingredients. Tobacco consumption can be divided into two broad categories, depending on whether it is smoked or not.

TOBACCO SMOKING. The most common form of tobacco use is the manufactured cigarette. This familiar product is made from a blend of as many as 150 lots of tobacco, wrapped most often in paper. The types of tobacco blended to produce the cigarette vary, depending on the regional taste preference; flue-cured tobaccos are popular in North America and most of Europe, whereas dark air-cured types are preferred in France and parts of North Africa and South America. Tar yields also vary, depending on the blend, lower levels generally being found in the industrial countries. Currently, there are about 280 cigarette brands in the United States alone.

Pipe smoking was probably the earliest form of tobacco use and often has had social or ceremonial significance in the local culture. Water pipes of various types are in common use throughout much of the Middle East, South Asia, China, and parts of Africa (IARC 1986). Often, molasses and other ingre-

dients are added to the tobacco mixture. Cigars are made from air-cured and fermented tobaccos and vary considerably in shape and size. Their smaller cousins, cheroots, are made from heavy-bodied tobaccos.

The most common tobacco product smoked in India and neighboring countries is the bidi, made by rolling a small amount of ground tobacco in a temburni leaf and tying it with a thread. In southeastern India, women practice reverse smoking, in which the smoker turns a cheroot around and keeps the lit end inside the mouth. Cloves are added to the tobacco mixture in Indonesia, to create local cigarettes called *kreteks*. Many other areas of the world also produce local tobacco-smoking products, each with its own special characteristic and name.

SMOKELESS TOBACCO. Smokeless tobacco products, consisting of tobacco leaf and a wide variety of flavoring and other ingredients, are used either orally or nasally. In industrial countries, chewing tobacco is produced by shredding tobacco leaf, pressing the leaf into bricks (plugs), or by drying it out and forming twists. Pieces are bit off and chewed or placed between the cheek (or lip) and gum. Snuff, which may be sniffed or placed in the mouth, has a much finer consistency than chew-

Table A-3. Worldwide Tobacco Leaf Production

Country	Production in 1990 (thousands of metric tons)	Annual change between 1980 and 1990 ^a (percent)
China	3,019	10.3
United States	737	(1.0)
India	564	2.1
Brazil	444	1.1
Turkey	288	3.5
Italy	205	4.6
U.S.S.R. (former)	200	(3.5)
Indonesia	150	3.6
Zimbabwe	140	3.0
Greece	125	0
<i>Region</i>		
Africa	378	2.8
North and Central America	940	(1.5)
South America	588	0.5
Asia	4,660	6.0
Europe ^b	667	(0.8)
Oceania	14	(3.0)
<i>Global</i>		
Industrial countries	1,791	(1.7)
Developing countries	5,654	5.1
Developing countries (except China)	2,635	1.3
Worldwide	7,446	3.0
Worldwide (except China)	4,427	0

a. Calculated by author. Baseline values at 1980 are averages of 1979-81. Decreases are given in parentheses.

b. Excluding the former U.S.S.R.

Source: FAO 1991.

ing tobacco and is made from powdered or finely cut tobacco leaves. Moist snuff taken orally (dipped) has been used for many years in Sweden and the United States, and it has recently become popular among adolescent males in those countries. Some tobacco companies have begun marketing it in small paper containers, like tea bags.

For centuries, plant products have been chewed by eastern Mediterranean and South Asian population groups. When tobacco was introduced, it was readily incorporated into many of these chewing habits (WHO 1988b). The most common oral use of tobacco is the betel quid, widely used in South Asia and parts of Oceania. It consists of a leaf from the betel vine wrapped around sliced or shredded areca nut, tobacco, slaked lime, and various flavorings. The large number of variations of oral use of tobacco, especially in South Asia, is remarkable.

TOBACCO PRODUCTION. Tobacco is grown in more than 120 countries worldwide, occupying a small portion (about 0.3 percent) of the world's arable land. This proportion, however, is considerably larger in some countries, such as Malawi (3.8 percent), Greece (3.1 percent), Bulgaria (2.7 percent), and Zimbabwe (2.6 percent). About 5 million hectares are under cultivation currently worldwide, with an average yield of about 1,500 kilograms of tobacco leaf per hectare (FAO 1991).

Global tobacco leaf production is given in table A-3. China is the world's leading producer of tobacco (40 percent), followed by the United States (10 percent) and India (8 percent). The majority of the world's tobacco is grown in Asia; 76 percent is produced in the developing countries worldwide.

The dominant trend in tobacco production is the 10.3 percent annual increase in China. Worldwide production of tobacco is increasing by 3.0 percent each year, but if China is excluded from the calculation, production is virtually stable. Production in the United States is decreasing at an annual rate of 1.0 percent per year.

The majority of tobacco leaf produced today is the flue-cured type because of increasing preference for its use in cigarettes. At the current price of tobacco in most countries of \$1.50 to \$3.50 per kilogram, the value of the world's annual tobacco leaf production can be estimated at \$10 billion to \$20 billion.

Approximately 85 percent of tobacco leaf grown worldwide is used for cigarettes. There is considerable variation among countries, however. Whereas virtually all tobacco is used for cigarettes in Japan, in the United States about 80 percent is used for cigarettes, 10 percent for cigars, and 10 percent for other tobacco products. In India, about 30 percent is used for making the bidi, 20 percent for chewing, 15 percent for cigarettes, and the remainder for a wide variety of tobacco products; about seven bidi are produced for each cigarette in India (USDA 1988).

Tobacco Consumption

Cigarette consumption is shown by country and region in table A-4. China is the world's leading consumer of cigarettes (31

Table A-4. Worldwide Cigarette Consumption

	Consumption in 1990 (thousands of millions)	Annual change between 1982 and 1990 ^a (percent)
<i>Country</i>		
China	1,641	7.2
United States	547	(1.6)
U.S.S.R. (former)	378	(1.5)
Japan	315	0.1
Brazil	164	2.7
Germany	162	1.5
Indonesia	141	6.3
Poland	104	1.5
Italy	96	(1.3)
France	96	1.1
<i>Region</i>		
Africa	199	1.8
North and Central America	695	(1.6)
South America	270	2.0
Asia ^b	2,734	4.6
Europe	923	0.2
Oceania	43	0.2
<i>Global</i>		
Industrial countries	2,299	(0.6)
Developing countries	2,943	4.5
Developing countries (except China)	1,302	1.9
Worldwide	5,242	2.0
Worldwide (except China)	3,601	0.2

Note: Consumption is defined as output plus imports minus exports.

a. Calculated by author. Decreases are given in parentheses.

b. Excluding the former U.S.S.R.

Source: USDA 1988, 1991.

percent), followed by the United States (10 percent), the Commonwealth of Independent States (former U.S.S.R.; 7 percent), and Japan (6 percent). Fifty-two percent of cigarettes are consumed in Asia. Worldwide, consumption is increasing about 2.0 percent per year, with the greatest rise occurring in the developing countries. Cigarette consumption has been decreasing at an annual rate of about 1.6 percent in the United States and 2.5 percent in the United Kingdom since 1982.

Because of increasing health concerns, the preference worldwide has been moving toward cigarettes with filter tips. In China, the percentage of cigarettes with filter tips was 41 percent in 1990, tripling the percentage of 1986. Filter-tipped cigarettes account for more than 95 percent of the cigarettes in Brazil, Germany, Japan, and the United States but for only 87 percent in Italy, 73 percent in Indonesia, 64 percent in Poland, 60 percent in France, and 28 percent in the former U.S.S.R. (USDA 1988).

Health concerns have also had an effect on the tar and nicotine levels of cigarettes. Median tar levels are less than 20 milligrams per cigarette in Germany, Japan, and the United States, but high levels are found in China (26 milligrams per cigarette) and Indonesia (36 milligrams per cigarette). Tar levels in the United Kingdom and the United States have been

falling at an annual rate of about 3 percent during the last twenty years (IARC 1986). Due to advances in technology and the fact that less tobacco is needed in filtered cigarettes, the amount of tobacco per cigarette in the United States has been declining by about 1.5 percent per year during the last thirty years.

The value of cigarette production worldwide is difficult to determine because a large component of the price is taxes. Taking an average price of approximately \$1.00 for a pack of twenty cigarettes as a crude benchmark leads to an estimate of the retail value of all manufactured cigarettes of \$150 billion to \$250 billion—a more than tenfold increase over the price of the tobacco leaf alone.

Few countries have carried out national surveys of smoking prevalence, and rates can vary markedly within a country, especially between the urban and rural areas. Limited surveys have been conducted in nearly all countries, however, and can be used to determine approximate national tobacco-use habits (see table A-5). Worldwide, about half of adult males and 10 percent of adult females smoke. The difference in rates between the sexes is largest in the developing countries, particularly in Asia. In a number of European countries, smoking rates among adolescent girls exceed those of the boys.

Higher education levels tend to be associated with lower smoking rates worldwide (Chasov, Oganov, and Glasunov 1984; Pierce 1989). For example, in China the smoking rate of male peasants was 81 percent, whereas that of white- and blue-collar workers was 42 to 58 percent (Tomson and Coulter 1987).

It is estimated that more than 200 million adults in South Asia use smokeless tobacco. In Indonesia and parts of India,

the habit is more common among women than men, who prefer to smoke. Smokeless tobacco habits often begin at very young ages, and prevalence rates of 15 to 25 percent for children ten years of age or younger have been reported (IARC 1985).

More than 10 million people use smokeless tobacco in the United States; annual sales amount to approximately \$1 billion. The situation is similar in Sweden, where more than 30 percent of the males age sixteen to thirty-five use snuff. Significant use by children younger than six years of age has been reported in some areas of the United States (Rouse 1989).

Tobacco Industry and Promotion

Approximately 5 million hectares are under cultivation for tobacco, 80 percent of which are in the developing countries. The tobacco manufacturing industry processes tobacco leaf into cigarettes, cigars, chewing tobacco, and a wide variety of other products, thereby increasing the value of the tobacco about tenfold. Few businesses are as profitable and as difficult to enter as this industry.

Tobacco Growers

Whereas an average tobacco farm in the United States has about 2 hectares planted in tobacco, in developing countries tobacco is often cultivated on smaller plots of 0.5 to 1.5 hectares. There are about 4 million tobacco farms worldwide. Each hectare yields an average of 1,500 kilograms of tobacco, resulting in an annual global production of about 7.5 million metric tons of tobacco leaf (FAO 1991). From estimates of labor use per hectare (USDA 1986), it can be determined that the average-size tobacco farm could be managed by a single full-time farmer, who would have substantial time left over, if it were possible to spread the workload evenly over the year. Extra hands are typically used at planting and harvesting time, however. Therefore, although tobacco could provide full-time employment for something less than about 4 million farmers, in reality it provides part-time employment for a larger number of farmers and laborers, very often women in developing countries.

It has been reported that 6 million people in India are employed in tobacco growing, and 35 million people are so employed worldwide (*Tobacco International* 1974; FAO, Committee on Commodity Problems 1989). It is relatively easy to see, however, that these estimates are somewhat excessive, because comparison with the number of hectares under cultivation (FAO 1991) shows that there would be more than fourteen farmers per hectare in India and about seven farmers per hectare of tobacco being grown worldwide.

Nearly always, tobacco is grown in rotation with other crops, such as maize, cotton, wheat, and soybeans. In most areas, tobacco is a competitor with food for the arable land. In parts of Greece, Turkey, Malawi, and Zimbabwe, however, the soil is regarded as unsuitable for other crops, and the issue of competition with food crops does not arise.

Table A-5. Smoking Prevalence Rates in Adults, 1985-90

<i>Most populous countries</i>	<i>Males (percent)</i>	<i>Females (percent)</i>
<i>Country</i>		
China	61	7
India ^a	52	3
U.S.S.R. (former)	65	11
United States	32	27
Indonesia	61	5
Brazil	40	36
Japan	66	14
Pakistan ^b	44	6
Bangladesh	70	20
Nigeria	29	20
<i>Global</i>		
Industrial countries	51	21
Developing countries	54	8
Worldwide	52	10

Note: Regional and global estimates are based on population-weighted results of surveys for the most populous countries in each category.

a. Includes bidi and other forms of smoking.

b. Includes chewers.

Source: Author's compilation from World Health Organization surveys.

In many developing countries, either the government or the tobacco industry provides considerable support to the tobacco farmers, often in the form of technical assistance and training, logistical support, and soft loans. Benefits of this support are observed beyond the tobacco crop alone, because the supported tobacco farmers also tend to produce superior yields of other crops grown in rotation or concurrently with the tobacco.

Over the years, improvement in agriculture technology has led to a significant rise in tobacco yield per hectare of land. Tobacco production worldwide would be much greater than the present level if it were not for a network of governmental programs to limit the size of the tobacco harvest each year in order to keep the price high enough to provide a reasonable profit for the farmer. A number of subsidies, incentives, and guaranteed price supports and other mechanisms are provided by governments to keep the tobacco-growing industry healthy. Such mechanisms provide excess income to the farmers, giving them an incentive and the means to band together to exert political influence to retain their preferential treatment. Of course, this phenomenon is not restricted to tobacco farmers.

Crop selection for farmers in a market economy is largely based on the maximization of net profits. For farmers in developing countries, a number of other factors also come into play. Tobacco is a labor-intensive crop, and tobacco provides employment for family and community members. Tobacco farmers can be assured of a relatively stable high price for their crops, often in hard currency. And, they do not face the usual problem of needing rapid transport to avoid spoilage—in areas often bereft of even rudimentary services—that is encountered with most food crops. The record-setting tobacco crop in China in 1985 was largely due to an increase in the relative price for tobacco combined with government policy changes giving the farmers greater freedom in planting decisions.

Tobacco provides the farmers with gross returns per hectare that are significantly higher than for all or most other crops, depending on the soil type. Still, considerable costs are incurred in the growing of tobacco. In the United States, in 1985, the cost of growing flue-cured tobacco amounted to 76 percent of the value of the crop produced; 21 percent was for labor; 19 percent for machinery; 10 percent for curing fuel; 10 percent for the plant bed, fertilizer, and pesticides; and the remainder for marketing and inspection fees and other farm management expenses (Grise and Clauson 1985). This excludes the cost of the land. In the United States, 14 percent of the tobacco farms were operated by tenants. Although the relatively high costs incurred in the growing of tobacco in the United States cannot be extrapolated to the world, the need for labor, fertilizers, pesticides, and transport is virtually certain, and these expenses can be estimated to be approximately half of the value of the crop worldwide.

Nevertheless, net receipts per hectare from tobacco often exceed or are close to the gross receipts from most other crops. For example, in India a hectare of tobacco produced a gross return of approximately 8,000 rupees and a net return of 3,000 rupees, whereas cotton and groundnuts produced gross returns

of about 2,500 rupees and net returns of 800 to 900 rupees (FAO 1982). In some developing countries, limits are set by the government on prices for food crops in order to provide low-priced food for urban centers; such limits reduce the incentive for farmers to grow food and increase the incentive to grow tobacco. Nearly all the considerable resources used for growing tobacco could easily be used for producing food instead. The generation of hard currency and the fact that tobacco requires very little arable land notwithstanding, tobacco is grown in a number of areas in developing countries where food is in short supply and could be grown. On the basis of the earlier estimates of approximately \$10 billion to \$20 billion as the value of world annual tobacco leaf production and approximately 4 million tobacco farmers worldwide (if they were full-time farmers), the average tobacco farmer worldwide would receive a gross return of \$2,500 to \$5,000 and a net return of about \$1,300 to \$2,500.

Although there has been considerable interest in determining which crops can be substituted for tobacco that would provide a suitable economic alternative for the farmer, this is a complicated issue. It depends on a number of factors, including soil types, climate, local dietary patterns, available manpower, transportation system, crop-destroying pests, local and external market prices, proximity to urban centers, processing plants, and trade centers; in addition there are the more controllable factors of local government policies on price supports, price limits, subsidies, production quotas and limits, and agricultural extension services for tobacco and other crops. Nevertheless, there appears to be sufficient reason to believe that a multinational effort, including governmental policy modifications, could produce a situation in a number of countries in which it would be financially advantageous for farmers to grow food rather than tobacco.

In the short term, however, the number of individuals addicted to tobacco use worldwide, many of whom would be willing to pay exorbitant prices, would indicate that the considerable industry made up of tobacco growing and tobacco processing will continue to exist for many years. It will exist as either a legal or a black-market activity until society norms change sufficiently to produce a tobacco-free generation.

Tobacco Manufacturing Industry

Approximately 45 percent of world cigarette production is controlled by state industries in centrally planned economies, and 14 percent is controlled by state-level tobacco monopolies; the remaining 41 percent is dominated by a few international conglomerates such as the British-American Tobacco Company and Rothman's International, based in the United Kingdom, and the Philip Morris Companies and the R. J. Reynolds Tobacco Company, based in the United States (USDA 1988). The forces which have led to the situation in which cigarette manufacturing is undertaken by a relatively limited number of large enterprises include the highly automated technology used for cigarette production, the need for sophisticated advertising and promotional techniques (in countries that permit advertising), and the high profitability, which provides

funds that can be used to diversify and to deploy for political advantage.

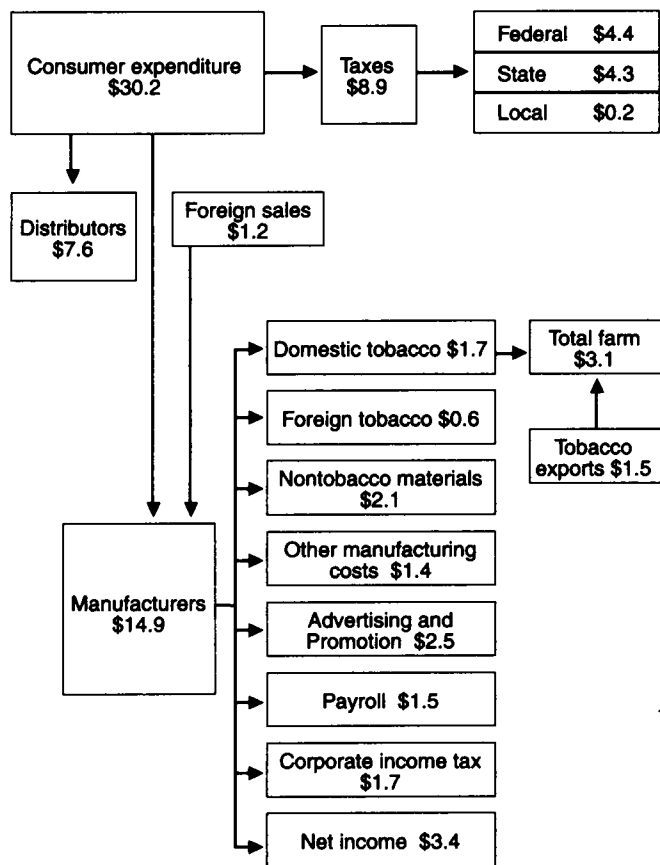
In centrally planned economies, excess income produced by tobacco is often used to offset shortfalls in other areas. There is little, if any, price competition among the conglomerates, primarily because of the high taxes on tobacco products, which minimize the effect of any change in the manufacturer's price. And, although they compete vigorously for market shares through advertising and promotional activities, they cooperate in many other areas, including the sharing of manufacturing facilities.

Over the last few years, the conglomerates have diversified extensively—sometimes into related industries such as transport and fuel, to control their costs, and sometimes into food, clothing, and cosmetics. Although it is often said that this diversification was undertaken because of projected future declines in tobacco consumption, there are significant economic reasons for it, related to the limited size of the tobacco market, surplus cash, and the need for continued growth to be economically competitive.

The U.S. cigarette industry is depicted in figure A-2. Of the retail price of cigarettes, about 30 percent goes for taxes, 25

Figure A-2. Cigarette Business in the United States, 1985

(billions of U.S. dollars)



Source: USDHHS 1989b.

percent to the distributors, and the remainder to the manufacturers. A net profit for the manufacturers of approximately 23 percent, after advertising, materials and manufacturing expenses, and taxes are removed, is the source of the considerable pool of funds available for diversification, market expansion, and other activities devised to maintain the position of the tobacco conglomerates.

Tobacco processing and manufacturing is the source of considerable employment—77,000 workers in the United States, 44,000 in Brazil, and 40,000 in Cuba (USDHHS 1992). Ninety-two percent of the cigarettes produced worldwide are consumed domestically (USDA 1988). Many of the tobacco-growing developing countries, however, especially in Africa, supply tobacco leaf but are effectively excluded from participating in the more lucrative industry of manufacturing cigarettes.

The leading exporter of cigarettes in 1990 was the United States, with 27 percent of the world's total, followed by the Netherlands, Hong Kong, Bulgaria, Germany, and the United Kingdom. Hong Kong exports six times more cigarettes than China. In the first half of the 1980s, Bulgaria was the world's leading exporter of cigarettes, mostly to the former U.S.S.R. Since 1989, however, the United States has been exporting more than twice as many cigarettes as any other country (164 billion in 1990). The former U.S.S.R. imports the largest number of cigarettes (65 billion or 15 percent of the total world imports), followed by Japan and France. In 1990, China exported 10.4 billion cigarettes and imported 6.2 billion (USDA 1991).

No large tobacco manufacturing company has yet admitted publicly that tobacco use is harmful to health. The virtual certainty of overwhelming liability suits is probably the primary reason for this position, even though it is indefensible before the battery of extensive evidence that tobacco is clearly the cause of many significant and deadly health problems. The lack of effective public education programs in many developing countries, combined with the efforts of many sectors within some countries which represent vested interests and which therefore do not want to hear about the detrimental effects of tobacco, give rise to the current situation in which tobacco habits are spreading rapidly throughout the developing world.

Advertising and Promotion

Numerous advertising and promotional activities have been undertaken by the tobacco companies. The industry claims that the purpose of advertising is to maintain brand loyalty and to achieve brand switches among smokers, rather than to induce nonsmokers to start, or current smokers to increase consumption. Advertising is viewed by the health sector, however, as one of the strongest inducements to smoking, especially to beginning it, and a ban on advertising is an important milestone in a national tobacco control program. The tobacco industry's arguments are weakened by the fact that they very strongly resist bans on advertising, much more so than other restrictive measures, and that tobacco advertis-

ing takes place even in countries where there is only one tobacco company. For example, for many years BAT had a monopoly of the cigarette market in Kenya and still was the country's fourth largest commercial advertiser (Muller 1978). It should be pointed out, however, that advertising is not needed to create a rise in tobacco consumption rates. Smoking increased significantly after World War II in many countries, such as in eastern Europe, where there was no advertising of any products until recently. Often in these countries, tobacco consumption trends were linked to trends in disposable income.

In industrial countries tobacco industry advertising promotes youth, fun, and adventure. In developing countries, it stresses success and a high quality of life. Creation or maintenance of an image is the key strategy in modern advertising. For example, the successful Marlboro cigarette brand advertising has even used a picture of only horses to promote its product—the well-understood image being the free-spirited life of the cowboy. Tobacco advertisements in the industrial countries in the 1960s and 1970s attempted to promote smoking among women by linking it to women's rights, proclaiming in the 1980s, "You've come a long way, baby."

In developing countries, tobacco is often advertised in a manner that would be unacceptable in the industrial countries in which the cigarettes are actually produced. Products have names such as "Long Life," "New Paradise," and "Sportsman," and the advertising is blatant and forceful. In countries in which tobacco's health risks are not widely known, advertising other than that of the tobacco industry's is limited and the general desire to become "Westernized" is extensively promoted in movies, so even a small amount of advertising expenditure can have a dramatic effect (RCP 1983).

A tobacco promotion technique that is becoming increasingly useful to the industry is the sponsorship of sports and cultural events. These activities give the tobacco industry much positive visibility, provide considerable leverage in some sectors, increase contacts with political decisionmakers, and are much more cost-beneficial than direct advertising.

In the United States, about \$3.3 billion are spent each year on tobacco advertising and promotion—27 percent for promotional allowances (paid to retailers and others to facilitate tobacco sales), 41 percent for a variety of other promotional activities, 14 percent for newspaper and magazine advertising, 11 percent for outdoor and transit advertising, and 7 percent for point-of-sale advertising (CDC 1990). Tobacco advertising in the United Kingdom amounts to more than 40 million English pounds per year. In Ghana, Malaysia, and Kenya, cigarette advertising accounts for 15 percent, 9 percent, and 5 percent of all advertising, respectively (Wickstrom 1979). The influence exerted on the media industry by this proportion of advertising is, of course, considerable. Eight of twelve American large-circulation women's magazines did not feature a single article on the hazards of smoking for a period of more than twelve years, despite regularly featuring articles on health issues (Whelan and others 1981).

The Role of Governments in Tobacco Promotion

Governments, in virtually all cases, fall short of being homogeneous decisionmaking and implementing bodies. For both market economies and planned economies, they consist of a number of competing factions.

MINISTRY OF HEALTH AND OTHER MINISTRIES. The key governmental factions involved with tobacco are the ministry of agriculture in close alliance with the ministry of finance, and the ministry of health, with, in general, a looser alliance to the ministry of education. The ministry of agriculture and the ministry of finance are nearly always two of the stronger ministries, with the former handling the crucial tasks of keeping the population fed and a large section of the population employed, and the latter handling the allotment of public funds, keeping the economy running, and monitoring the balance of payments. Conversely, although the ministry of health handles an important and politically sensitive function, it is generally thought of as one of the weaker ministries. Further, both the ministry of health and the ministry of education are often viewed by the other ministries as bottomless pits for absorbing public funds.

Ministries are influenced from without by a combination of specific constituencies and broad public opinion. A large group of tobacco farmers with sufficient cash receipts to organize themselves is a political force to be reckoned with. Lucrative taxes from the production, import, export, and sale of tobacco provide a reliable source of government revenues, often providing a significant portion of government income and thereby capturing the alliance of the ministry of finance. In cigarette-producing countries, however, the most important political force to be dealt with is usually the cigarette manufacturing industry, which produces for itself excess revenues that are considerably greater than those available to the farmers.

The specific constituency for the ministry of health largely consists of doctors, who are trained to diagnose and treat disease rather than to deal with disease prevention. Only a small proportion of employees, if any, in a ministry of health is likely to have any training to deal with tobacco control issues, such as legislation, public education, or childhood education. Although it is this ministry which must take the lead in the struggle against tobacco, a considerable portion of its efforts in this regard involve working through other ministries and organizations to achieve the desired results.

Also, rather than disease prevention, the public most often demands more hospitals, clinics, and medicines from the ministry of health. And as always in prevention, the constituency that benefits the most—those who have been prevented from acquiring the diseases and suffering the morbidity and premature death—never know it. Only an epidemiologist can even give an estimate of how many would have been in this group were it not for preventive efforts long ago.

Further, the general public around the world, especially in developing countries, has a difficult time understanding how

a tobacco habit today will result in an increased chance (not a certainty) of an internal disease twenty or thirty years later. In some cultures it is not even possible to express this concept in the local language.

TAXES. Governments may tax tobacco in many ways, including taxes on the farmer, based on the amount of tobacco leaf grown; taxes on the tobacco manufacturing companies, based on the numbers of cigarettes or amount of other tobacco products produced; taxes on import of tobacco leaf or manufactured products; and taxes at the time of retail sales. Taxes are a significant factor in the price of tobacco products. For example, they amount to more than 70 percent of the retail price of cigarettes in Brazil, Canada, Denmark, Italy, and the United Kingdom; more than 50 percent in Mexico and Zimbabwe; and about 30 percent of the price in the United States.

Cigarettes provide a considerable portion of government income in many countries—between 1 and 2 percent of total government revenue in Italy, Japan, and the United States; between 2 and 3 percent in Canada and Denmark; and between 3 and 4 percent in Greece and the United Kingdom. In Argentina and Brazil, they provide 22.5 and 7.4 percent of government revenue, respectively (OECD 1985; USDHHS 1992). Tobacco taxes yield more than \$1 billion each year for the Indian government.

From a government perspective, taxes on tobacco have a number of advantages. Not only are they a significant source of income for both the central and local governments, they are relatively easy to collect—the tobacco manufacturing companies simply transfer the funds into a government account; a large collection agency is not needed. Further, governments must try to raise tax revenue without too much public resistance. Because tobacco consumption is generally greater in the lower socioeconomic classes, tobacco taxes raise significant revenues from this large public sector voluntarily, with virtually no complaints. Still, tobacco taxes are basically transfers of funds. They do not increase national wealth but are a convenient means of raising government revenue.

SUBSIDIES. As mentioned earlier, governments provide a wide range of direct and indirect supports to promote tobacco, primarily on behalf of the farmers. These include price supports, incentives, production quotas, soft loans, import restrictions, agriculture extension services, foreign-marketing limitations, state trading, and state monopolies. Often a developing country will invest in tobacco cultivation to provide a source of employment and hard currency. In the United States the tobacco price support program cost only \$66 million from 1933 to mid-1986; it is estimated that since then, however, it has cost approximately \$1 billion (Warner 1988).

EXPORTS AND IMPORTS. Although significant strides have been taken to control tobacco consumption in the United States, section 301 of the U.S. Trade Act has been used to

impose sanctions on countries, such as Japan, South Korea, and Taiwan (China), that have bans on or barriers to imported tobacco products. These countries have subsequently opened their doors to U.S. tobacco to avoid possible trade sanctions. Cigarette advertising jumped from fortieth place to second place in total advertising time in Japan in two years, primarily as a result of American-style advertising campaigns.

In China, producing and marketing are controlled by the government through the China National Tobacco Company, which uses quotas and allocations. China does not export significant numbers of cigarettes, and virtually all imported cigarettes come from Hong Kong. Companies who wish to export cigarettes to China must purchase tobacco leaf grown in China. Foreign tobacco companies were among the first to take advantage of the special economic zones and favored investment conditions recently offered. In 1988, the R. J. Reynolds Tobacco Company opened a \$21 million cigarette factory in Xiamen. A German company is building a plant in Hong Kong for the primary purpose of producing cigarettes for China.

Tobacco export and import are a considerable source of currency transfer among countries. Tobacco leaf accounts for 48 percent of the total commodity export earnings for Malawi and 23 percent for Zimbabwe. A comparison of the total value of tobacco imports with that of exports shows that the United States has the most significant positive currency flow (approximately \$2 billion per year) from tobacco. Bulgaria, Greece, the Netherlands, Turkey, Zimbabwe, and probably Brazil and Malawi all have a currency flow from tobacco of more than \$100 million annually. The former U.S.S.R. incurs the greatest currency loss (approximately \$800 million), and China, Egypt, France, Italy, Japan, and Spain have losses of more than \$100 million each.

Tobacco Control Strategies

The aim of tobacco control programs is to establish nonuse of tobacco as normal social behavior, and the key to successfully doing so is effective national action. The basic components of a tobacco control program are legislative measures, education and information, and national program organization. These components are described in the following sections and are summarized in table A-6. Focusing on any single component, such as public information alone, however, is unlikely to be successful. The optimal strategy is a comprehensive one in which all important components are integrated; persistent pressure should be maintained across the entire range of activities and greater efforts made in specific areas as priorities dictate and as resources and opportunities make themselves available.

The control of tobacco presents a different problem from most in public health. In this instance, the resistance to action is not an insect vector or a shortage of trained health care workers but rather is often a well-organized international industry with substantial monetary resources and an active media

Table A-6. Effectiveness, Cost, and Resistance from Tobacco Industry for Components of a National Tobacco Control Program

Component	Effectiveness	Cost ^a	Resistance from tobacco industry
<i>Legislative measures</i>			
Increased taxation on tobacco products and other economic measures	Very	Inexpensive	Strong
Ban on tobacco advertising	Very	Inexpensive	Strong
Health warnings on tobacco products and advertisements	Marginal	Inexpensive	Moderate
Limiting the amount of harmful substances in tobacco products and specifying the amount on packages	Marginal	Inexpensive	Little
Protecting the rights of nonsmokers	Moderate	Inexpensive	Moderate
Protecting minors	Moderate	Inexpensive	Little
<i>Education and information</i>			
Informing leaders and key social groups	Moderate	Inexpensive	Little
Encouraging medical personnel and public figures to take leadership roles	Very	Inexpensive	Little
Informing the public about health risks	Moderate	Expensive	Little
Encouraging the public, especially children, never to adopt any tobacco habit	Very	Expensive	Little
Encouraging people who use tobacco to stop or decrease use	Marginal	Expensive	Little
Encouraging workers in high-risk industries and pregnant women to stop any tobacco habit	Moderate	Moderate	Little
<i>National program organization</i>			
Establishing a national agency to plan and coordinate the program	Moderate	Moderate	Little

a. For an agency charged with planning and running a national tobacco control program.

b. Such as on public transportation and in restaurants and work sites.

Source: Author.

campaign; in addition the industry provides considerable revenue for governments and the media industry. Therefore, although some national-level strategies have been developed, implementation of these measures often meets with considerable resistance. Continuous evaluation of the strategies of tobacco control and counterstrategies of the tobacco industry form the basis of the modern public health effort in this area.

National tobacco control programs will, of course, differ among countries, depending on a number of factors, including the extent and type of current tobacco use, the extent of current tobacco-associated health problems in relation to other health problems, other pressing social problems, the extent of dependence on the tobacco industry, local cultural attitudes and public perception of the tobacco problem, and the commitment of the national leaders and physicians with respect to disease prevention. In most industrial countries, the diseases associated with tobacco are highly prevalent, and as a result the public is in general agreement with control efforts. In many developing countries, however, cigarette smoking has been common for only a few years, and the resulting health problems are just emerging. The public may therefore not yet see the need for reduction in tobacco consumption.

Legislative Measures

One of the best measures of national commitment to tobacco control is the extent of national legislation. Antitobacco laws vary in rigor and scope: some are stringent, others exert moderate controls, and still others impose only weak restrictions;

some regulate to limit supply and others regulate to limit demand; and some provide a comprehensive range of controls. Further, some laws are enacted on paper but never enforced and hence are only of symbolic importance. The role of legislation in helping to establish nonsmoking as normal social behavior, however, goes beyond its direct effect; legislation expresses public policy and sends a clear message to the population that tobacco use is harmful. The enactment of legislation represents a maturity of public concern about the health effects of tobacco and is a significant milestone in national public health policy. As of 1986, sixty-four countries had enacted legislation, whereas ten years earlier only nineteen had done so (Roemer 1986). Critics say that legislation can be expensive or difficult to enforce. But experience has shown that if the legislation is not leading public opinion by too great a distance and is accompanied by effective education programs, it can be implemented and will serve to change the social environment and hasten the decline of tobacco consumption.

The tobacco industry will vigorously oppose many aspects of legislation, particularly those measures that have been shown to be the most effective—price increases and advertising bans (see table A-6). The industry's opposition is often couched in the form of indirect attacks on the legislation that appeal to people's fears that their right to freedom is being taken away or that "Big Brother" is looking over their shoulder.

Success in achieving the enactment of legislation requires extensive public information efforts and action by citizens to persuade their legislators of the necessity for legislation (Peachment 1984). As the WHO Expert Committee on Smok-

ing Control Strategies in Developing Countries stated in 1983: "It may be tempting to try introducing smoking control programs without a legislative component, in the hope that relatively inoffensive activity of this nature will placate those concerned with public health, while generating no real opposition from cigarette manufacturers. This approach, however, is not likely to succeed. A genuine broadly defined education program aimed at reducing smoking must be complemented by legislation and restrictive measures" (WHO 1983, p. 43).

Admittedly, it is difficult to demonstrate that a single legislative intervention will reduce consumption because so many factors are involved in the use of tobacco. But studies have shown a decline of smoking associated with controls on advertising, introduction of rotating warnings, price increases, and airing of antismoking messages. Multifaceted legislative measures, in conjunction with other tobacco control measures, have resulted in substantial reduction in tobacco consumption, for example in Finland and Norway (Roemer 1987).

Hong Kong, Ireland, Israel, and New Zealand have taken the significant step of banning the importation and sale of smokeless tobacco products. Voluntary agreements between the government and industry, such as those in Denmark and the United Kingdom, have sought to control promotion of tobacco, but problems of interpretation and enforcement of the agreements have led health authorities to call for replacement of those agreements with legislation.

PRICE POLICY. In nearly all countries, the government plays a significant role in setting the price of cigarettes, primarily through taxes, and there is considerable variation in price among countries. For example, in northern and western European countries the retail price of twenty cigarettes varied from \$4.17 in Norway and \$3.60 in Denmark to \$0.80 in France and \$1.21 in Italy in 1987. The tax rate on cigarettes in European countries varies from 35 to 87 percent of the retail price, averaging about 53 percent (Roemer 1987). Tax rates are within this range for the majority of countries worldwide.

The most significant reductions in tobacco consumption are apparently produced by a combination of regular price increases of tobacco products and an effective health education program. If either portion is missing, the effect is markedly reduced, and a decrease in tobacco tax rates can easily negate the effect of other components of a tobacco control program.

The effect of raising taxes on tobacco products is measured by the price elasticity of demand, the percentage of change in tobacco consumption associated with a 1 percent increase in price, adjusted for inflation. The price elasticity for cigarettes in North America and western Europe is approximately -0.4; that is, for every 10 percent increase in the price of cigarettes, consumption will fall 4 percent (Townsend and the Advisory Committee 1987; USDHHS 1992). The fall in consumption is greater for teenagers (an elasticity of -1.4 [Lewit 1981]), particularly young males and those in the lower socioeconomic groups. Further, an increase in price will have a greater effect on the decision to start or stop smoking than it will on the

decision to smoke fewer cigarettes; thus it will have an important role in reducing the number starting a tobacco habit.

The strong association between cigarette price and consumption has also been observed in developing countries. For example, in India, cigarette sales declined by 15 percent after the excise tax was more than doubled on the popular manufactured cigarette brands in 1986 (USDA 1987).

An increase in cigarette prices not only affects cigarette consumption; it also results in a switch to lower-priced brands (often unfiltered), to hand-rolled cigarettes, and to other tobacco products, and if excessive it could lead to an increase in bootlegging. Tobacco duties were increased by 39 percent in the Federal Republic of Germany in 1982. By the next year, the sale of name brands had dropped by 17 percent, but the sales of low-priced cigarettes and of tobacco for hand-rolled cigarettes had increased markedly, making up for 60 percent of the decline of sales in name brand cigarettes (Ramstrom 1986). Although increases in cigarette prices are clearly one of the most effective public health tools available to reduce cigarette consumption, only about half of the effect is a real reduction in cigarette consumption, the other half being a restructuring of the market. This problem can largely be solved by market-neutral simultaneous increases in the cost of all tobacco products, with greater proportional increases in the least expensive, such as tobacco for hand-rolled cigarettes, which needs a proportional price increase in relation to cigarettes of more than three to one.

The most frequent arguments against the raising of tobacco prices are that it will lead to a decrease in governmental tobacco tax revenues and that it will increase inflation. In reality, however, an increase in tobacco taxes will cause a rise rather than a fall in tax revenues for a country (Warner 1984; Townsend 1987). The primary reason for this is that although a price increase will result in a decrease in consumption, the decrease in consumption is proportionally smaller than the increase in tax revenues. It has been estimated that a 10 percent increase in the tobacco tax rate will result in a 5 to 8 percent rise in tobacco tax revenues (Godfrey and Maynard 1988; Jones and Posnett 1988). It is obvious that this relationship will not continue to hold if prices are raised to astronomical levels, but they can be raised considerably in all countries before a point of diminishing returns is reached. It must be pointed out also that by price increases, we mean increases above the rate of inflation. If price increases do not keep pace with inflation, consumption will increase and tax revenues will fall.

An increase in tobacco prices could be inflationary, especially if the cost of tobacco items is linked to a cost-of-living index. For this reason, a retail price index excluding the price of tobacco and alcohol products is now calculated by the Commission of European Commodities. An increase in taxes may even be deflationary, however, because taxes take money out of circulation.

BAN ON ADVERTISING. Advertising is the strongest component of the tobacco industry's promotional effort. In the

United States, the tobacco industry puts more than 8 percent of the retail price of the cigarettes directly back into advertising and promotion, an amount in excess of \$3 billion annually (FTC 1988; CDC 1990). The magnitude of this financial commitment is perhaps the best evidence that the payoff for the tobacco industry is dramatic. Tobacco advertising has an elasticity of approximately 0.09; that is, for a 10 percent increase in advertising expenditure, the tobacco industry can expect about a 1 percent rise in consumption (Townsend and the Advisory Committee 1987).

As mentioned earlier, the industry claims that the purpose of advertising is only to improve its share of the market, and not to induce nonsmokers to start a tobacco habit. This view has been negated by studies, however, which show, for example, that brand loyalty for cigarettes is higher than for most other consumer products (Tye, Warner, and Glantz 1987) and that the decision of teenagers to start smoking is largely a result of the positive image promoted by the tobacco industry's advertising. Recent advertisements by the R. J. Reynolds Tobacco Company in Europe and the United States have featured the cartoon character "Joe Camel"; targeting of the youth in this campaign was evidenced by a 91 percent name recognition rate in six-year-olds.

The first priority of legislation in this area should be a total ban on tobacco advertising on television, radio, and other mass media. Promotion of tobacco through the industry's sponsorship of sports and cultural events and other indirect advertising should also be restricted. The tobacco industry often evades advertising restrictions by advertising nontobacco products such as clothing, shoes, and lighters, using advertisements that are virtually indistinguishable from earlier tobacco advertisements. A total ban or at least some restriction on tobacco advertising has been enacted in at least fifty-seven countries (Roemer 1987). Of course, it should be mentioned that the former U.S.S.R., China, and some other countries already have complete bans on all commercial advertising; continuing increases of tobacco consumption in those countries is probably related to increases in disposable income and availability of cigarettes.

OTHER TYPES OF LEGISLATION. The placing of health warnings on tobacco product packages is required in at least forty-three countries worldwide (Townsend and the Advisory Committee 1987). The use of strong rotating health warnings has largely solved the problem of the ineffectiveness of a single familiar warning.

Although epidemiological studies indicate that low-tar cigarettes are associated with a reduction in lung cancer rates of approximately 20 percent (Hammond and others 1976), there is no reduction in harmful effect with respect to cardiovascular disease, respiratory function, pregnancy complications, and other diseases. Low-yield cigarettes, however, are used by the industry to promote the erroneous concept that there is such a thing as a safe cigarette. Far from being safe, however, these cigarettes make it easier for youth and women to start smoking. Smokers will change their habits to compensate (such as by inhaling more deeply or smoking more frequently), and the

idea itself that these cigarettes may be less harmful leads to the initiation of this habit by large numbers of youth. Further, by giving smokers support for their rationalizing behavior, such cigarettes weaken their will to quit the harmful addictive habit.

Restrictions on tobacco use in public places, such as the banning of smoking or the setting aside of areas for smokers in public places, such as restaurants, public transport, and the workplace, have been enacted in forty-eight countries (Roemer 1987). These restrictions are designed to protect nonsmokers from the effects of passive smoking and to convey the message that smoking is not normal social behavior and can be harmful to nearby nonsmokers. Studies have shown an increase in lung cancer in the nonsmoking wives of smokers that is three and one-half times greater than in the nonsmoking wives of nonsmokers. In fact, some passengers in the nonsmoking sections of airplanes experience nicotine levels comparable to those of individuals in the smoking section. In the United States this has led to the banning of smoking on all internal commercial flights of six or fewer hours.

There has been little resistance from the tobacco industry to legislation enacted to prevent youth from smoking, mostly by sales restrictions and prohibition in schools. The industry is well aware that if one desires to encourage teenagers to do something, just make it illegal until they reach adulthood. Nevertheless, such laws are important because they communicate to the youth that smoking is harmful. When the laws are enforced and supported by strong education programs, the combined effect can be a considerable reduction in the number of young people who start smoking.

In the past, laws concerning sales to minors have been poorly enforced, but recent experience has shown that the imposition of fines in a few well-publicized cases, together with required posting of notices that it is illegal to sell tobacco to minors, can achieve compliance with the laws. Prohibiting or restricting sales of tobacco in vending machines is another measure necessary to prevent sales to minors.

Legislation can also be enacted to eliminate government subsidies of the growing and manufacturing of tobacco. The U.S. and some other governments are against international legislation in the field of tobacco—apparently because of the precedent it would set in further hindering free trade among countries.

Education and Public Information

A common misconception is that people will change their behavior if they are told how dangerous something is. The overwhelming majority of adults worldwide have been informed of the health risks associated with tobacco, but this, by itself, has had little effect in slowing the spread of tobacco habits. Informing populations about the risks is, however, a necessary component of a comprehensive education program; mass media is effective in changing knowledge, attitudes, and beliefs. And although mass media can sometimes influence behavior, individual contact is often necessary to change behavior significantly (Flay 1987).

Some prefer to view the tobacco, alcohol, and drug-control strategy efforts as a situation of supply versus demand, with education leading the effort to reduce demand. The use of this model in the tobacco field, however, is often supported by the tobacco industry, who in general know that their Achilles' heel is legislation and that the industry can easily outspend public education in advertising. Equal resources on both sides of a struggle between advertising and public information to influence the public's perception of tobacco would be theoretically interesting, but the tobacco industry would never agree to a level playing field. The industry strongly resisted the ban on tobacco advertising on television in the United States until the health sector started running television commercials with Brooke Shields showing how socially unattractive smoking was; the industry capitulated shortly thereafter.

KEY GROUPS. The first step in an education program is to inform key groups of the ill effects of tobacco and what should be done (see table A-6). One of the key groups is physicians, who should be persuaded to take leadership roles. If the physicians do not adopt healthy lifestyles, the public will not adopt them either.

THE GENERAL PUBLIC. A cornerstone in a national education program is informing the general public about the risks associated with tobacco. An appeal to fear, however, is ineffective as a long-term information strategy. To be effective, a program must be run for a long time and should be characterized by simple messages on a common theme, affecting society's image of the tobacco user. For an example of highly successful efforts, it is sufficient to observe a few of the tobacco industry's advertising campaigns in industrial countries; these campaigns are well funded, generally involve a variety of medias and extensive visual images, and are of high professional quality. The countering of these images, in the United States, for example, has led to the creation of public information offices which produce similarly high-quality public material, often involving well-known and trusted public figures, that is aimed at establishing nonsmoking as preferable, normal social behavior.

Frequently, the public's perception of risk differs markedly from the epidemiological reality. For example, risk-opinion surveys indicate that the public in the United States views nuclear power, handguns, and motor vehicles as greater risks than smoking (Upton 1982), whereas in reality smoking is far more dangerous: 30 percent of all cases of cancer in the United States are attributable to tobacco use (Doll and Peto 1981). More than one-sixth of all deaths in males over the age of fifteen in India are attributable to tobacco (Gupta 1988). As in Western countries, chronic diseases are the primary cause of adult mortality in India, but whereas tobacco habits are prevalent, other high-risk habits resulting in chronic disease, such as diets high in animal fat and low in fiber, are not common.

One of the few large prospective controlled studies on the primary prevention of cancer was conducted in India. This investigation of more than 36,000 tobacco chewers and smokers showed that a combination of mass media and personal

advice led to tobacco habit cessation rates of 4 to 12 percent in three study areas (Gupta and others 1986).

SCHOOLCHILDREN. The most important component in the control of tobacco is childhood education. Health education programs in schools, however, are generally poor worldwide because health is often not a priority and teachers only rarely have training in health education. It is important that school-child programs begin at a young age, because by the age of twelve a child's attitudes and skills in health decisionmaking are largely formed. Further, health education should be comprehensive, covering topics from personal hygiene to nutrition, and should not focus only on a single topic such as tobacco.

Over the years, certain strategies in childhood health education have been determined not to work. These include the appeal to fear, in which individuals are told they will get cancer or heart disease if they smoke, and an emphasis on technical information, in which, for example, the aspects of tobacco production and cigarette manufacture are stressed. Often, this latter strategy is counterproductive, leading to experimentation with tobacco. Moreover, the threat of disease and death in far-off years is rarely effective with young people.

A number of comprehensive school-based education programs have been developed, primarily during the last fifteen years. Effective programs consist of two interlinked components—health beliefs and skills development. The beliefs and opinions of the children concerning health should be openly discussed, with small group participation activities whenever possible. The focus should be on susceptibility to problems thought by children to be important; a child is often more concerned about the smell of tobacco smoke or offending others than about the risk of heart disease or cancer. Perceived benefits and barriers to risk-reducing behaviors should also be discussed, with the emphasis on nonuse of tobacco as normal social behavior.

Children also need to develop social resistance skills (to resist peer pressure, poor adult models, advertisements, and mass media), decisionmaking skills, and assertiveness. The setting of lifestyle goals by a child also often forms a basis for resistance of peer pressure in the later childhood years.

Most effective programs use either the existing teachers, older children (peer leaders), or a combination of both, rather than specialized health education teachers. The "child-to-child" program (UNESCO 1988) was designed for use in developing countries and uses older children to teach the younger children, building on a linkage already existing in many of these countries. This UNICEF-sponsored program is used in fifty-eight countries.

Two of the most well known programs in industrial countries are the "Growing Healthy" and "Know Your Body" programs. More than 1 million schoolchildren in the United States are studying "Growing Healthy." Both programs have been shown to reduce the initiation of smoking by more than 50 percent, as well as conferring other health benefits ("Results of the School Health Education Evaluation" 1985; Walter, Vaughan, and Wynder 1989).

SMOKING CESSATION. People continue smoking in the face of overwhelming evidence of its detrimental effects because of the social acceptance of smoking, the addiction, and, where permitted, the constant pressure of advertising. The nicotine in cigarettes is one of the most addictive substances known. There is, however, a wide range in the level of addiction in a smoking population. It has been estimated that about 95 percent of the 37 million Americans who have stopped smoking have stopped on their own with no support groups or other assistance. Still, stopping smoking often requires three, four, or five attempts. Only a small portion of smokers participate in cessation clinics and in the associated research studies.

In the United States, approximately 70 percent of all adults see a physician at least once a year, but only about half of smokers have ever been advised by a physician to stop smoking. Although physicians should play an important role in smoking cessation, the most effective cessation activities involve both physicians and nonphysicians, and frequent contacts with the smokers. Reliance on single methods, such as nicotine chewing gum or counseling, is not as effective as combinations of methods, in which change of the social environment for the smoker is stressed. The average success rate of cessation programs at one year is about 5 to 10 percent (Kottke and others 1988). Routine minimal (30 to 40 seconds) advice to quit smoking, given by physicians and primary health care workers, would produce significant effects worldwide simply as a result of the large number of contacts. Specialized cessation advice for expectant mothers and workers in high-risk industries can easily be incorporated into existing health counseling services.

Tobacco Control Programs

An effective national effort against tobacco normally requires the establishment of a national agency or office to plan and coordinate all aspects of the program. A budget for such a national agency in an industrial country of average size is in the range of \$1 million to \$10 million. Frequently, the creation of a national group to review the scientific literature and recommend specific national actions to the public is the driving force behind the political will to take the necessary steps. Even though it has been mainly countries in northern Europe and North America that have developed national tobacco control programs, countries such as Chile and India have also taken significant steps in formulating such programs.

In many ways, the war against tobacco is analogous to the war against drugs. Demand-side strategies can help to slow the growth, but supply-side strategies are also necessary in order to reduce consumption dramatically. It should be pointed out, however, that in the United States and most countries, substantially more resources have gone to fighting drugs, which have claimed far fewer lives than tobacco.

The first national-level body to review the evidence against tobacco was the Royal College of Physicians in the United Kingdom, whose first report was published in 1962. This physician-led group drew up recommendations for action and in 1971 established the organization Action on Smoking and Health (ASH) to coordinate voluntary efforts against tobacco

use. In the United Kingdom, smoking among males twenty years and older fell from 52 percent in 1974 to 35 percent in 1986; for females, the corresponding decline was from 41 percent to 31 percent (Pierce 1989). Because of the lack of legislation and poor results from the voluntary agreements with the tobacco industry, the most significant component of the United Kingdom effort against tobacco has been health education.

The comprehensive Tobacco Act was passed in Finland in 1976. This legislation was one of the first and most successful national program actions taken against tobacco; one component of this act obligated the state to set aside 0.5 percent of the tobacco excise tax to combat smoking. In 1975, 40 percent of adult males were daily smokers, and rates had been increasing yearly. But by 1984, there had been a reduction to 33 percent (Leppo and Vertio 1986).

The first report on smoking and health by the U.S. surgeon general in 1964 was an extensive review of the scientific literature, and the key political step against tobacco in the United States. This report was communicated to the public and served as the basis for formulating policy to control tobacco consumption. The series of surgeon general's reports has continued and now numbers twenty-two, and as a set it is the most comprehensive review and analysis of the association between tobacco and health in the world today. In the United States, smoking prevalence among adults fell from 40 percent in 1965 to 29 percent in 1987 (USDHHS 1989a).

Lung cancer mortality (or incidence) rates are perhaps the best marker of significant progress against smoking on the national level. A hard look at the lung cancer mortality trends, however, compels one to conclude that the fight to control this disease worldwide is currently being lost.

In 1985, WHO reported its study of cancer mortality trends covering the period 1960–80 in twenty-eight industrial countries, representing 75 percent of the population of the industrial world. The most dramatic rise in age-adjusted mortality was registered for lung cancer—76 percent for men and 135 percent for women (WHO 1985). Mortality trends for males in selected countries are given in figure A-3. The mortality reductions seen in Finland and the United Kingdom, where comprehensive antismoking campaigns were first implemented, are the strongest evidence of effective national programs.

Economic Analysis and Conclusions

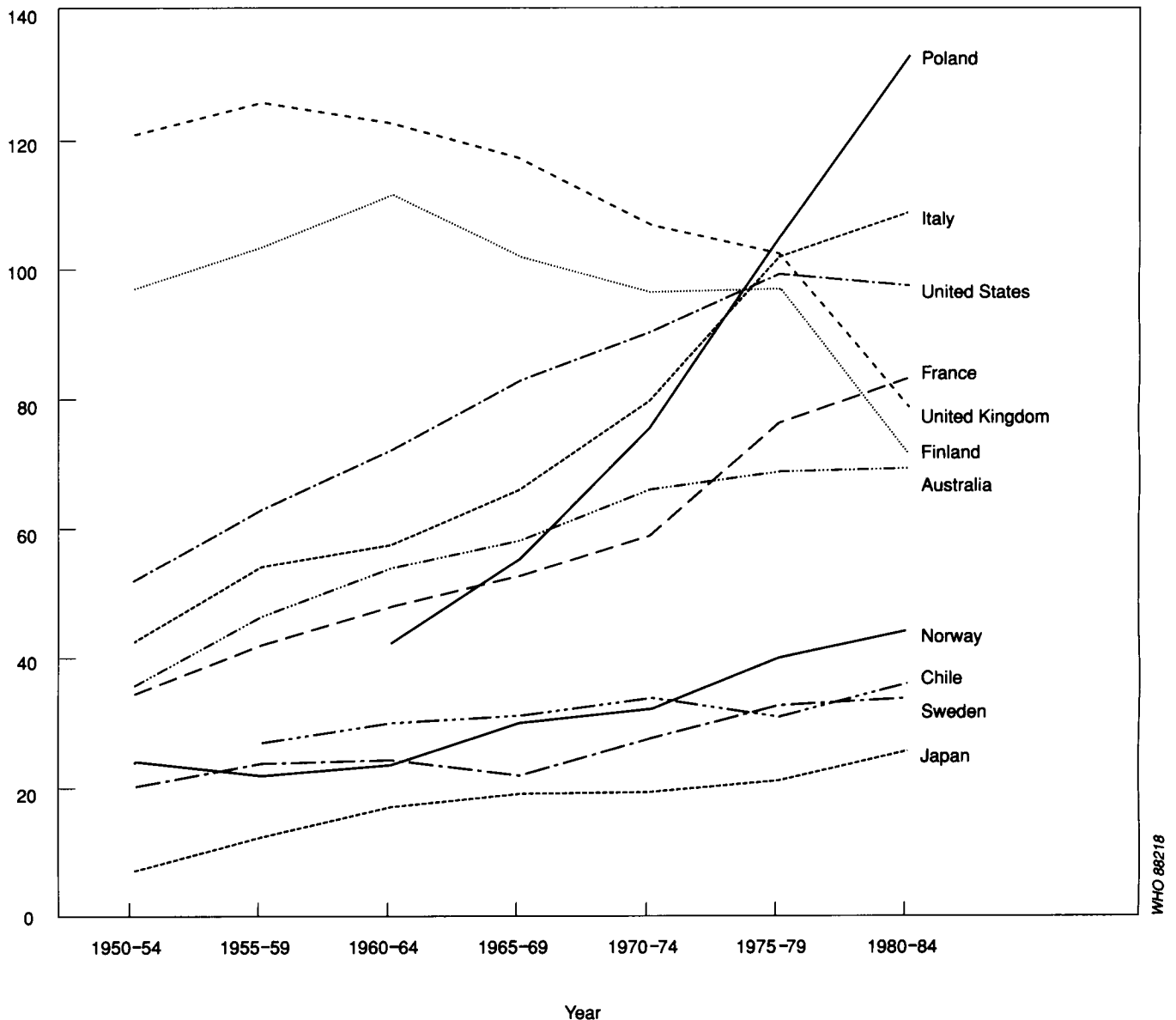
As the debate on the control of tobacco worldwide matures, it is turning more to economic analyses. When the public listens to this debate, it is faced with incomprehensibly large financial amounts on both sides of the issue. In this section the value of the retail market of cigarettes (VRM) is used as a yardstick against which the costs and benefits can be compared.

The Economic Benefits of Tobacco Use

The economic benefits of tobacco can be divided into the following categories:

Figure A-3. Trends in Age-Specific Lung Cancer Mortality of Males Age 50–54, Selected Countries

Age-specific death rates per 100,000



WHO 88218

Source: WHO 1987.

- Employment in the tobacco manufacturing industry
- Employment for wholesalers, distributors, and retailers
- Employment in the advertising and media industry
- Income for tobacco farmers
- Taxes raised on tobacco products
- Export of tobacco

For the United States in 1985, about 30 percent of the value of cigarette sales went for taxes, and 25 percent to the distributors. The farmers received about 6 percent of this VRM (\$1.7

billion) and a similar amount for tobacco exports. About 5 percent (\$1.5 billion) of the VRM was spent by the manufacturing industry for salaries to its workers and 8 percent for advertising and promotion (see figure A-2; USDHHS 1989b). For Canada in 1979, about 50 percent of the VRM went for taxes, 7 percent to the farmers, 17 percent to the retailers and distributors, and 25 percent to the manufacturing industry (Collishaw and Myers 1979). In Northern Ireland in 1984, 74 percent of the VRM was cigarette tax revenue. One-third of the remainder went to retailers and two-thirds to the manufacturing industry as employee earnings (£31.6 million; Nelson

1986). In 1981–82, about 74 percent of the VRM in Egypt was tax revenues; 4 percent went to the retailers and 3 percent to the salary of employees in tobacco manufacturing (£E 21.4 million; Omar 1987).

The export of tobacco leaf is an important source of income for countries such as Brazil, Malawi, Turkey, and Zimbabwe. The majority of cigarettes worldwide are produced with domestic tobacco, however, and the value of the tobacco leaf is typically only 10 percent of the value of the processed tobacco products. The export of tobacco leaf is a source of hard currency transfer from industrial countries to a few developing countries, but on a global scale this is only a small part of the economic picture, less than 1 percent of the value of the worldwide retail cigarette market.

IF TOBACCO WERE ELIMINATED. Consider the changes that would take place if tobacco were eliminated worldwide. As opposed to arguments of the tobacco industry, there would not be an absolute loss equivalent to the total value of all generated salaries and all indirect goods and services associated with the industry and its employees. Rather, the people employed in the tobacco manufacturing industry would move to their “next-best” employment opportunity, with possibly a few being unemployed in the short term and a small number permanently unemployed. Instead of being involved in manufacturing a product that causes harm, they would disseminate to other businesses and the economy would simply adjust. The step down in total income for this group would be no more than a few percent and probably less than 10 percent overall, even when adding in the unemployed. As an example, for Canada, employment in the manufacturing industry has a value of 25 percent of the VRM; the real decrease associated with the elimination of tobacco would be a 2.5 percent drop of the VRM. Similarly, for the people employed in tobacco advertising, distribution, sales, and other businesses related to the tobacco industry, individuals would either have to adjust their businesses or seek “next-best” employment.

For the newspapers and magazines that depend heavily on tobacco advertising, its removal would be, from their perspective, a virtual full loss of tobacco advertising revenues. But again, the resulting staff movement would be to the “next-best” employer. It is conceivable that a small number of newspapers and magazines that depend heavily on tobacco advertising may fail. The cost of those failures, however, is a small price for society to pay for the elimination of tobacco. A rough estimate would be a 10 percent drop from current benefit levels.

If tobacco were eliminated, the farmers would shift to producing the “next-best” crop, often providing considerably less income per hectare. The resources needed for growing a hectare of tobacco, however, such as labor and fertilizer, are considerably greater than those needed for growing the “next-best” crop. If land were not a limiting factor, and it often is not, then the farmer could grow many hectares of another crop with the resources used to grow a single hectare of tobacco. Therefore, although farmers might expect a drop in net return of 50 to 70

percent per hectare from the “next-best” crop, if there were no shortage of arable land the decline in their profits would not be nearly as large.

Tax revenues from tobacco products should not be considered an economic benefit from tobacco because they are merely transfer payments—they do not affect the gross national product or the standard of living. Taxes can be raised in other ways. As mentioned previously, cigarette consumption is greater in the lower socioeconomic groups; perhaps tax revenues could be raised in a more equitable manner.

Thus, if tobacco were eliminated, the real loss in economic benefit to society would be of the order of 5 to 10 percent of the VRM for the industrial countries. In developing countries, even where tobacco-related employment is sometimes considerable, because of the “next-best” employment and crop phenomenon, the economic loss associated with the elimination of tobacco would still be only a small portion of the VRM, probably never nearing 25 percent of the VRM in any country.

It should be noted that the entire VRM came from disposable income paid out by tobacco users. If tobacco were eliminated, nearly all this disposable income of tobacco users and their families would alternatively be used for the purchase of other goods and services—thereby supporting the economic development of those sectors, providing employment and tax revenues, although probably at a lower tax rate. Tobacco is a legal product only because of history. If it were to try to enter the market today, it could not do so because of the built-in safeguards against harmful products that now exist around the world.

The Economic Costs of Tobacco Use

Virtually all analyses of health care expenditure attributable to tobacco have been conducted in industrial countries, and even from a single country the results of those analyses vary considerably. Nevertheless, the broad conclusions are relatively consistent.

The costs of tobacco use are often categorized into one of three groups:

- Direct health care costs—the costs of treating the diseases attributable to tobacco
- Indirect costs of lost productivity—lost income because of illness and premature death attributable to tobacco
- Nonmedical costs—including accidental fires and the loss of wood for the curing of tobacco

For the United States, direct health care costs associated with smoking were estimated in 1982 to be \$16 billion (7 percent of the national total health care costs and 73 percent of the VRM) in 1980 (Rice and Hodgson 1983). The corresponding estimate of indirect mortality and morbidity cost was \$26 billion (118 percent of the VRM). The Office of Technology Assessment of the U.S. Congress estimated the direct health care costs to be \$22 billion (70 percent of the VRM) and

indirect costs of lost productivity to be \$43 billion (140 percent of the VRM) for 1985, but the office put a wide range on the possible total—from \$38 billion to \$95 billion (U.S. Congress 1985). In both analyses, the indirect costs alone were greater than the retail value of the cigarettes sold, or the VRM. Economic costs of tobacco have also been calculated separately for six states of the United States and for New York City; for these areas either the total of direct and indirect costs or the indirect costs alone exceeded the VRM (Shultz 1986).

For Canada in 1979, direct health care costs were estimated to be \$1.7 billion (Canadian), or 60 percent of the VRM; lost income due to premature mortality was estimated to be \$3.3 billion (Canadian), or 110 percent of the VRM; and fire damage was estimated to be \$85 million (Canadian), or 3 percent of the VRM (Collishaw and Myers 1979). For Northern Ireland in 1984, the cost to the individual smoker and family was estimated to be \$271 million, or 137 percent of the VRM; and the cost to the employer, \$135 million, or 68 percent of the VRM (Nelson 1986). For Egypt, direct health care costs associated with tobacco use were estimated in 1982 to be \$151 million, or 17 percent of the VRM; and indirect costs of lost productivity, approximately \$78 million, or 9 percent of the VRM (Omar 1987). Also, Egypt had to pay an amount equal to 16 percent of the VRM to import foreign cigarettes and the tobacco leaf and other materials to make domestic cigarettes.

Although there is wide variation among countries, it is possible to conclude that in industrial countries in which smoking has been common for many years, the total of the direct health care costs and the indirect costs of lost productivity are significantly greater than the value of the retail cigarette market, and that either the direct cost or the indirect cost, taken alone, is likely to be at least two-thirds of the value of this market. In developing countries, the costs of tobacco use are directly linked to the proportion of disease attributable to tobacco, which in turn is directly associated with the length of time of significant tobacco consumption in the country. The costs in these countries will continue to rise in the next twenty to twenty-five years and will ultimately reach the same levels as in the industrial world.

The previous cost analysis does not take into account that in the absence of tobacco, people will still die and thus incur health costs, although years later. Although tobacco-associated diseases tend to be more expensive to treat than other competing causes of death at the same age, health costs for more elderly individuals would also be more expensive on average. An analysis in Switzerland included a comparison of the health care costs of a smoking population with those of a hypothetical matched nonsmoking population; the costs were virtually identical (Leu and Schaub 1985). It should also be pointed out that direct health care costs are resources that could be directed to other uses and are therefore not real economic losses to society. The indirect costs of lost productivity, however, are real losses to society: contributions of energy and knowledge, often in the years of peak productivity and income, have been wasted.

I conclude that the dominant economic cost of tobacco use in industrial countries is the indirect one of lost productivity, which is approximately two-thirds of the value of the retail cigarette market, or larger. Male smokers are more than twice as likely to die during their working years (before age sixty-five) than nonsmokers (Mattson, Pollack, and Cullen 1987). The cost in developing countries is likely to reach that same level, at a rate which depends on the twenty to twenty-five-year lag time in health problems after the start of considerable tobacco use among the population.

As mentioned previously, a number of governments subsidize tobacco growing or manufacture through a wide variety of measures. Elimination of these subsidies would free these government resources.

There are no reliable estimates of the value of the wood consumed for the curing of tobacco worldwide, but the value is almost certainly in excess of \$1 billion. And the price of recovery from desertification is probably also of considerable magnitude—if, indeed, it is possible at all in those areas with insufficient rainfall. Further, if the wood were not used for curing, much of it would probably enter the marketplace and thereby reduce the price of fuel for the general public.

Each year about 3 million premature deaths worldwide are due to tobacco. This tobacco is grown on 5 million hectares of land. Hence, it can be estimated that each seven hectares of tobacco grown will result in approximately four deaths each year: one death from lung cancer, one death from ischemic heart disease, one death from another cancer or cardiovascular disease, and one death from a respiratory or other disease.

Conclusions

When all the economic costs and benefits of tobacco use are summarized and compared, the single element that emerges as determining the conclusion is the simple fact that male smokers are more than twice as likely to die during their working years (before age sixty-five) than nonsmokers. The energy and productivity of these people have been wasted. If tobacco were eliminated worldwide, virtually all other economic concerns related to this event would either be of a much smaller order of magnitude, or the system would simply adjust—individuals would seek employment elsewhere, farmers in developing countries would grow food rather than tobacco, and taxes would be raised by other means.

Of course, the real reason for reducing tobacco consumption is disease and suffering, not economics. It is virtually impossible to put a value on life or suffering. Whatever amount we are willing to pay to keep ourselves alive and healthy is the value of health. On top of the economic loss to society due to tobacco, one must consider the immeasurable suffering and loss deriving from the premature death of millions of individuals.

The control of tobacco is one of the most important public health issues facing mankind, if not the most important. Future generations will look back and wonder why it took so long for us to ban such an obvious hazard.

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